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U. S. Department of Agriculture
Bureau of Agricultural Economics

Handbook
of
United States Grades
for
Rough Rice

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U. S. Department of Agriculture
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Effective March 1, 1927

COMPILED BY
E. G. BOERNER
In charge, Grain Investigations
W. D. SMITH
In charge, Rice Investigations
R. M. GEHL
Rice Investigations, Grain Division



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UNITED STATES GRADES FOR ROUGH RICE

For the purposes of the United States grades for rough rice:

Rough rice.—Rough rice shall be rice grown in continental United States which contains not less than 50 per cent of kernels of rice from which the hulls have not been removed, and which may contain not more than 50 per cent of matter other than rice and not more than 10 per cent of cereal grains of a kind or kinds other than rice.

HONDURAS ROUGH RICE (CLASS I)

This class shall include the rices known commercially as Honduras and Mortgage Lifter, and may include not more than 10 per cent of whole kernels of rice of any other class or classes.

EDITH ROUGH RICE (CLASS II)

This class shall include the rice known commercially as Edith, and may include not more than 10 per cent of whole kernels of rice of any other class or classes.

FORTUNA ROUGH RICE (CLASS III)

This class shall include the rice known commercially as Fortuna, and may include not more than 10 per cent of whole kernels of rice of any other class or classes.

CAROLINA ROUGH RICE (CLASS IV)

This class shall include the rices known commercially as Carolina and Storm Proof, and may include not more than 10 per cent of whole kernels of rice of any other class or classes.

LADY WRIGHT ROUGH RICE (CLASS V)

This class shall include the rice known commercially as Lady Wright, and may include not more than 10 per cent of whole kernels of rice of any other class or classes.

BLUE ROSE ROUGH RICE (CLASS VI)

This class shall include the rices known commercially as Blue Rose, Greater Blue Rose, and Improved Blue Rose, and may include not more than 10 per cent of whole kernels of rice of any other class or classes.

EARLY PROLIFIC ROUGH RICE (CLASS VII)

This class shall include the rice known commercially as Early Prolific, and may include not more than 10 per cent of whole kernels of rice of any other class or classes.

JAPAN ROUGH RICE (CLASS VIII)

This class shall include the rices known commercially as Japan, and may include not more than 10 per cent of whole kernels of rice of any other class or classes. This class shall be divided into two subclasses designated as (a) Japan rough rice, and (b) California-Japan rough rice.

SUBCLASS (A) JAPAN ROUGH RICE

This subclass shall include all rices known commercially as Japan possessing the characteristics of rice of this class as grown east of the Rocky Mountains.

Grade requirements for the classes Honduras, Edith, Fortuna, Carolina, Lady Wright, Blue Rose, and Early Prolific rough rice, and for the subclass Japan rough rice

Grade No. ¹	Damaged kernels		Red rice	Foreign material and finely broken kernels			Rice of other classes
	Total	Heat damage		Sepa- rable	Inseparable ¹		
					Mud lumps	Cereal grains	
	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	
1-----	2	0.0	0.5	2	0.0	0.0	1
2-----	4	.1	3.0	4	.1	.1	2
3-----	7	.2	6.0	7	.2	.2	4
4-----	10	.3	10.0	10	.3	.3	6
5-----	15	.4	20.0	15	.5	.5	10
6-----	15	.5	30.0	15	1.0	1.0	10
Sample grade.	Sample grade shall be rough rice of the class Honduras, or Edith, or Fortuna, or Carolina, or Lady Wright, or Blue Rose, or Early Prolific, or the subclass Japan, respectively, which does not come within the requirements for any of the grades from No. 1 to No. 6, inclusive, or which has any commercially objectionable foreign odor, or is sour, heating, or hot, or is otherwise of distinctly low quality.						

¹ For special grade designations for weevily, damp, wet, seedy, very seedy, mud-dragged, stained, and musty rough rice see specifications given on pp. 7 to 10, inclusive.

The rough rice in each grade above sample grade shall be cool.

SUBCLASS (B) CALIFORNIA-JAPAN ROUGH RICE

This subclass shall include all rices known commercially as Japan possessing the characteristics of rice of this class as grown west of the Great Plains area of the United States.

Grade requirements for the subclass California-Japan rough rice

Grade No. ¹	Damaged kernels		Red rice	Foreign material and finely broken kernels			Rice of other classes
	Total	Heat damage		Sepa- rable	Inseparable ¹		
					Mud lumps	Cereal grains	
	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
1.....	0.2	0.0	0.1	2	0.0	0.0	0.1
2.....	.4	.1	.2	4	.1	.1	.2
3.....	.7	.2	.5	7	.2	.2	.4
4.....	1.0	.3	1.0	10	.3	.3	.6
5.....	1.5	.4	2.0	15	.5	.5	1.0
6.....	2.0	.5	5.0	20	1.0	1.0	1.0
Sample grade.	Sample grade shall be rough rice of the subclass California-Japan which does not come within the requirements for any of the grades from No. 1 to No. 6, inclusive or which has any commercially objectionable foreign odor, or is sour, heating, or hot, or is otherwise of distinctly low quality.						

¹ For special grade designations for weevily, damp wet, seedy, very seedy, mud-dragged, stained, and musty rough rice see specifications given on pp. 7 to 10, inclusive.

The rough rice in each grade above sample grade shall be cool.

GRADES FOR MIXED ROUGH RICE

Mixed rough rice.—Mixed rough rice shall be a mixture of any two or more of Classes I, II, III, IV, V, VI, VII, and VIII which does not meet the requirements of any one of such classes.

Mixed rough rice shall be graded according to each of the grade requirements common to the class or subclass of rough rice which predominates over each other class or subclass in the mixture, except that all of the grade requirements in any class as to the maximum percentages of other rices shall be disregarded. The grade designation of mixed rough rice shall include, successively, in the order named, the number of the grade, the word "mixed," and, in the order of its predominance, the name and approximate percentage of each class or subclass of rough rice which constitutes 10 per cent or more of the mixture; but if only one class or subclass exceeds 10 per cent of the mixture the name and approximate percentage of that class or subclass shall be added to the grade designation, followed by the name and approximate percentage of at least one other class or subclass.

GRADES FOR DAMP AND WET ROUGH RICE

DAMP ROUGH RICE

In the case of rice other than of the subclass California-Japan rough rice all rough rice containing more than 14 per cent but not more than 15.5 per cent of moisture shall be considered damp.

In the case of rice of the subclass California-Japan rough rice all rough rice containing more than 15 per cent but not more than 16 per cent of moisture shall be considered damp.

Damp rough rice shall be graded and designated according to the grade requirements of the grade applicable to such rice if it were not damp, and there shall be added to and made a part of such grade designation the word "damp."

WET ROUGH RICE

In the case of rice other than of the subclass California-Japan rough rice all rough rice containing more than 15.5 per cent but not more than 17 per cent of moisture shall be considered wet.

In the case of rice of the subclass California-Japan rough rice all rough rice containing more than 16 per cent but not more than 17 per cent of moisture shall be considered wet.

Wet rough rice shall be graded and designated according to the grade requirements of the grade applicable to such rice if it were not wet, and there shall be added to and made a part of such grade designation the word "wet."

NOTE.—All rough rice containing more than 17 per cent of moisture shall be considered of low quality and shall be graded "Sample grade."

GRADES FOR SEEDY AND VERY SEEDY ROUGH RICE

The determination of whether rough rice is seedy, very seedy, or sample grade on account of seeds shall be made after the removal of separable foreign material.

SEEDY ROUGH RICE

If, after the removal of separable foreign material, in the case of rice other than of the subclass California-Japan rough rice, rough rice contains more than 0.1 per cent but not more than 0.5 per cent of weed seeds it shall be considered seedy.

If, after the removal of separable foreign material, in the case of rice of the subclass California-Japan rough rice, rough rice contains more than 0.5 per cent but not more than 1.5 per cent of weed seeds it shall be considered seedy.

Seedy rough rice shall be graded and designated according to the grade requirements of the grade applicable to such rice if it were not seedy, and there shall be added to and made a part of such grade designation the word "seedy."

VERY SEEDY ROUGH RICE

If, after the removal of separable foreign material, in the case of rice other than of the subclass California-Japan rough rice, rough rice contains more than 0.5 per cent but not more than 1 per cent of weed seeds it shall be considered very seedy.

If, after the removal of separable foreign material, in the case of rice of the subclass California-Japan rough rice, rough rice contains more than 1.5 per cent but not more than 3 per cent of weed seeds it shall be considered very seedy.

Very seedy rough rice shall be graded and designated according to the grade requirements of the grade applicable to such rice if it were not very seedy, and there shall be added to and made a part of such grade designation the words "very seedy."

NOTE.—If, after the removal of separable foreign material, in the case of rice other than of the subclass California-Japan rough rice, rough rice contains more than 1 per cent of weed seeds it shall be considered of low quality and shall be graded "Sample grade." If, after the removal of separable foreign material, in the case of rice of the subclass California-Japan rough rice, rough rice contains more than 3 per cent of weed seeds it shall be considered of low quality and shall be graded "Sample grade."

GRADES FOR WEEVILY ROUGH RICE

Weevily rough rice.—Weevily rough rice shall be all rough rice which is infested with live weevils or other insects injurious to stored rice.

Weevily rough rice shall be graded and designated according to the grade requirements of the grade applicable to such rice if it were not weevily, and there shall be added to and made a part of such grade designation the word "weevily."

GRADES FOR STAINED, MUD-DRAGGED, AND MUSTY ROUGH RICE

STAINED ROUGH RICE

Stained rough rice shall be rough rice which has been distinctly discolored by climatic conditions or in any other manner.

Stained rough rice shall be graded and designated according to the grade requirements of the grade applicable to such rice if it were not stained, and there shall be added to and made a part of such grade designation the word "stained."

MUD-DRAGGED ROUGH RICE

Mud-dragged rough rice shall be rough rice in which there are more than 2 per cent of kernels with a distinct amount of mud clinging to them.

Mud-dragged rough rice shall be graded and designed according to the grade requirements of the grade applicable to such rice if it were not mud-dragged, and there shall be added to and made a part of such grade designation the word "mud-dragged."

MUSTY ROUGH RICE

Musty rough rice shall be rough rice which has an unmistakable musty odor.

Musty rough rice shall be graded and designated according to the grade requirements of the grade applicable to such rice if it were not musty, and there shall be added to and made a part of such grade designation the word "musty."

MILLING QUALITY

Milling quality shall be based on the value of the rough rice for milling purposes. The test for milling quality shall be determined by use of the Smith shelling device, described in mimeograph circular USGSA-GI, No. 34, dated August, 1925, issued by the Bureau of Agricultural Economics, United States Department of Agriculture, or as determined by any device or method giving equivalent results.

Milling quality shall be determined as prime milling quality, good milling quality, medium milling quality, fair milling quality, ordinary milling quality, or low milling quality. The milling quality so determined and stated shall be added to the grade designation.

Examples: No. 1 Blue Rose rough rice, prime milling quality.

No. 1 Blue Rose rough rice, fair milling quality.

No. 3 Blue Rose rough rice, ordinary milling quality.

No. 1 California-Japan rough rice, prime milling quality.

No. 1 California-Japan rough rice, good milling quality.

No. 3 California-Japan rough rice, prime milling quality.

DEFINITIONS

Basis of determinations.—Each determination of general appearance, temperature, odor, moisture, separable foreign material and finely broken kernels, milling quality, mud-dragged, and insects injurious to stored rice shall be on the basis of the lot of rice as a whole. Each determination of red rice, damaged kernels, and other classes shall be upon the basis of the rice after shelling. All other determinations shall be upon the basis of the rice when free from separable foreign material and finely broken kernels and before shelling.

Percentages.—Percentages, except in the case of moisture, shall be percentages ascertained by weight.

Percentage of moisture.—Percentage of moisture shall be that ascertained by the moisture tester and the method of use thereof described in Bulletin No. 1375, dated February, 1926, issued by the United States Department of Agriculture, Bureau of Agricultural Economics, or that ascertained by any device and method giving equivalent results.

Damaged kernels.—Damaged kernels shall be kernels and pieces of kernels of rough rice which have been distinctly damaged by water, insects, or by any other means. Sound broken kernels

and kernels of which the hulls only have been damaged shall not be considered as damaged kernels.

Heat-damaged kernels.—Heat-damaged kernels shall be kernels and pieces of kernels of rough rice which have been distinctly discolored by external heat or as a result of heating caused by fermentation.

Separable foreign material and finely broken kernels.—Separable foreign material and finely broken kernels shall be all matter other than rice which will not pass through a No. 12 sieve and all kernels and pieces of kernels of rough rice and all foreign matter which will pass through a No. $6\frac{1}{2}$ sieve.

No. 12 sieve.—A metal sieve perforated with round holes twelve sixty-fourths inch in diameter.

No. $6\frac{1}{2}$ sieve.—A metal sieve perforated with round holes six and one-half sixty-fourths inch in diameter.

Mud lumps.—Mud lumps shall be lumps of dried mud which will pass through a No. 12 sieve but which will not pass through a No. $6\frac{1}{2}$ sieve. Mud lumps which will not pass through a No. 12 sieve or which will pass through a No. $6\frac{1}{2}$ sieve shall function in grading only as “separable foreign material and finely broken kernels.”

Cereal grains.—Cereal grains shall include barley, rye, wheat, emmer, spelt, einkorn, corn, grain sorghums, and oats, and shall not include buckwheat, flaxseed, and wild oats. Cereal

grains which will not pass through a No. 12 sieve or which will pass through a No. 6½ sieve shall function in grading only as “separable foreign material and finely broken kernels.”

Weed seeds.—Weed seeds shall be grains, kernels, or seeds, either whole or broken, of any plant other than rice or other cereal grains. Weed seeds which will not pass through a No. 12 sieve or which will pass through a No. 6½ sieve shall function in grading only as “separable foreign material and finely broken kernels.”

Red rice.—Red rice shall be whole or broken kernels of rice of which the bran is distinctly red or pink in color.

IMPORTANT FEATURES OF GRADING ROUGH RICE

THE SAMPLING OF ROUGH RICE

The obtaining of a representative sample is essential to the determination of the true grade of a given lot of rough rice. If the sample obtained is not representative no amount of care in making determinations for the grading factors will establish the true grade of the rough rice sampled. Consequently, great care should be taken in sampling in order that the sample on which the grade of the rough rice is to be based shall truly represent the rough rice sampled.

The sample should be approximately 2 quarts in size. If the time to elapse between the drawing of the sample and the determination of grade would permit of such change in the condition of the sample as to affect the grade, at least $1\frac{1}{8}$ pints should be inclosed in an air-tight container and the remainder, if any, in a clean cloth sack.

In the case of bulk rough rice in a carload lot, or in a wagon, at least five probes (with a double-shell compartment trier 60 inches long, or one giving equivalent results), and as many more as may be necessary, in the discretion of the sampler, shall be taken from the rice in different parts of the car or wagon, as the case may be.

In case of bulk rice in a canal boat, barge, ship, or other vessel at least five probes (with a double-shell compartment trier, or one giving equivalent results), and as many more as may be necessary, in the discretion of the sampler, shall be taken at points through each hatch or opening in the deck, or may be drawn from the spout or on the belt or other conveyor from the vessel if taken in such a way as to be representative of the entire lot or parcel.

SAMPLING DEVICES

GRAIN TRIER (PROBE) AND SAMPLING CANVAS

For obtaining a representative sample from a carload of bulk rice the use of the double tube, separate compartment grain trier (probe) shown in Figure 1 is recommended.

The use of such a trier makes it possible for the sampler to note any unevenness in loading and to ascertain the approximate location and quantity of any mixture of rice or of dirty, heating, or damp spots, etc., found in any part of the rice. To assist in doing this it is advisable to use a canvas 5 by 2 feet in dimensions on which to empty the grain from the trier. The grain should be emptied lengthwise on the canvas, each separate trierful apart from the others, so that the grain from each compartment can be noted separately.

In case of bulk rice being loaded aboard a canal boat, barge, ship, or other vessel, the sample may be taken from the spout or on the

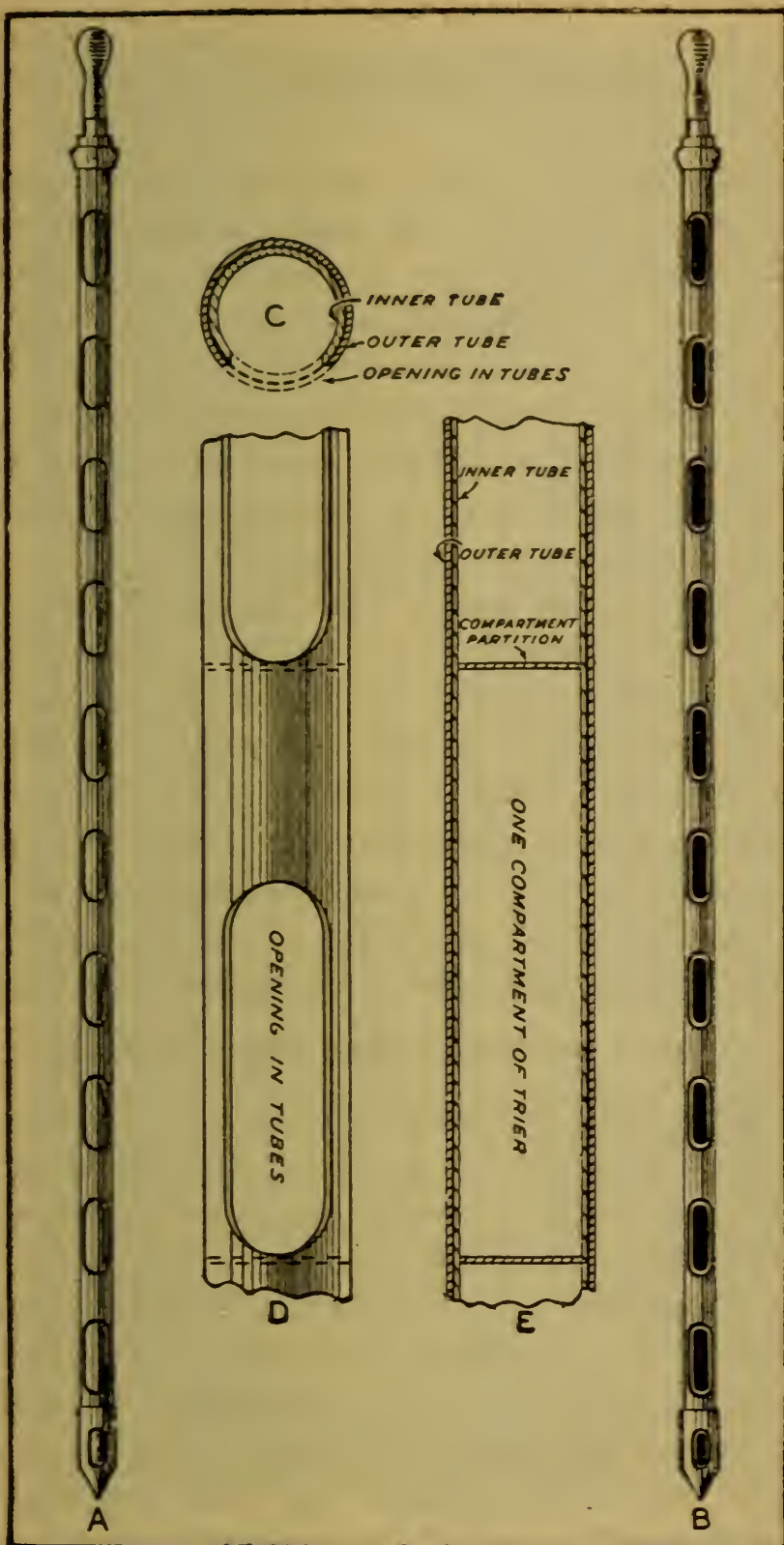


FIG. 1.—Rice trier (probe). Double-tubed, separate-compartment trier (probe), recommended by the Department of Agriculture. A, Trier closed; B, trier open; C, cross section showing double tubes, D, sectional view; and E, longitudinal view, showing compartments

belt or other conveyor to the vessel if taken in such a way as to be representative of the entire lot or parcel.

In case of rice in sacks, samples shall be drawn from as many individual sacks selected at random as will enable the sampler to procure an average and representative sample of the entire lot. In case a lot is of such size or is stacked in such a manner that a representative sample can not be obtained, no official inspection of the rice should be made until a representative portion of it is accessible for sampling.

In case it shall appear that a material portion of a lot or parcel of rice is in any manner distinctly inferior to the remainder of the lot or parcel, a separate sample otherwise complying with these instructions shall be taken from such portion and from the remaining portion. There shall be filed with such sample a statement showing the estimated quantity of each portion of the rice from which each such sample was taken.

SAMPLE DIVIDER (BOERNER SAMPLER)

After a representative sample of the lot or parcel of rice to be graded is obtained it is usually necessary to reduce its size considerably in order that the grade may be determined by careful analysis. To reduce the size of a sample of rice containing foreign substances of different specific gravity or size than of the rice with which they are mixed and at the same time obtain a sample as representative as the original is scarcely possible except by mechanical means.

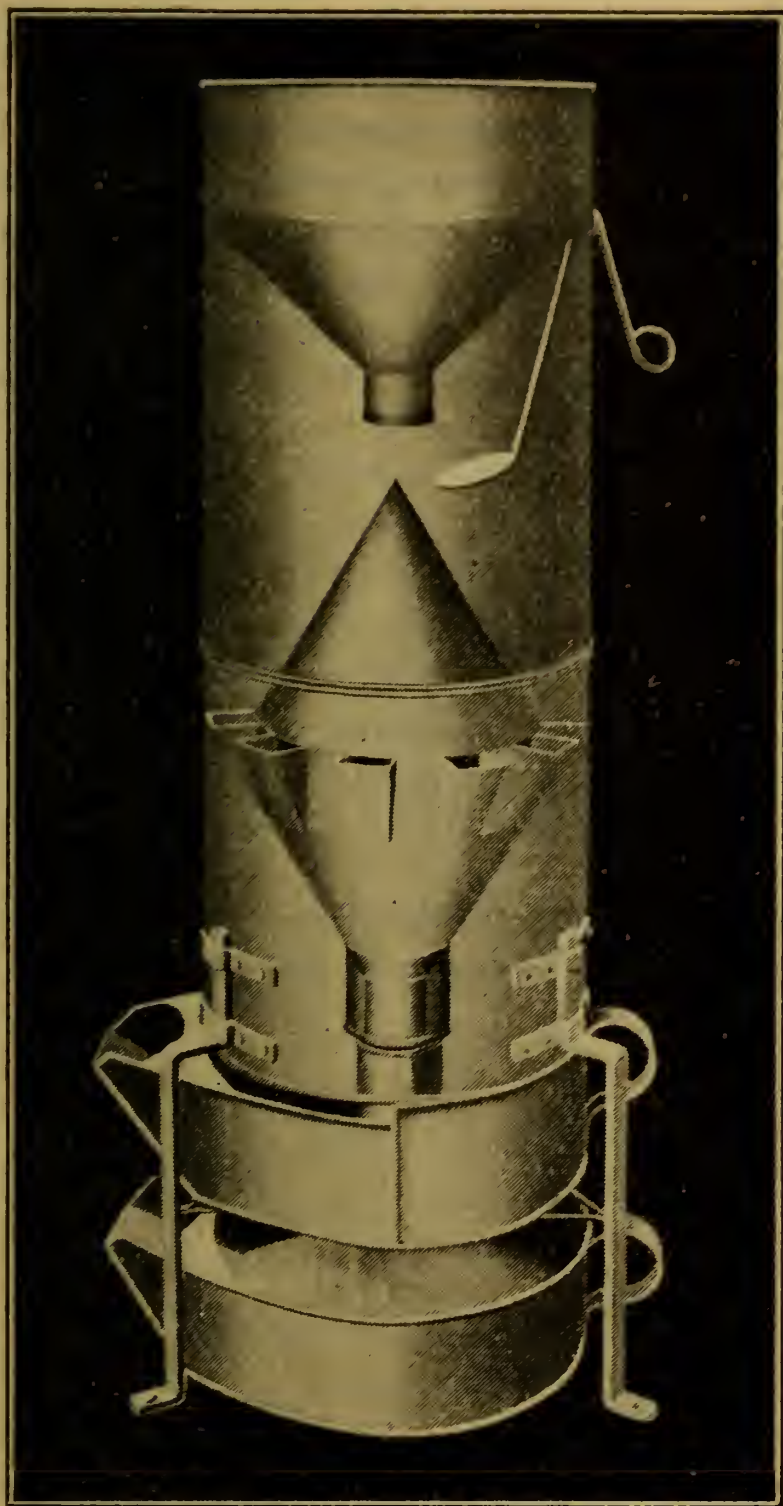


FIG. 2.—Modified Boerner sampler. For use in obtaining a representative portion from a larger sample for analyses purposes

Figure 2 shows a device, generally referred to as the "Modified Boerner sampler," which will divide a sample into smaller portions and still maintain the proper proportions for the various factors of the original sample. In the operation of this device the rice is placed in a hopper at the top of the machine and released, when it passes through an opening at the bottom of the hopper, down the sides of a cone the point of which is directly under the center of the opening. Around the base of the cone are pockets or openings. The rice falling down the sides of the cone is cut into separate streams, which, a little farther on, merge into two streams. Streams Nos. 1, 3, 5, etc., unite into one stream which empties into one receptacle, and streams 2, 4, 6, 8, etc., unite into another stream which empties into a second receptacle.

The device is fully described in United States Department of Agriculture Bulletin No. 857.

METHOD OF MAKING MOISTURE TESTS

Owing to the numerous methods of making moisture determinations and the wide variations in the results obtained by the different methods the tester and method described in Department of Agriculture Bulletin No. 1375, issued by the Bureau of Agricultural Economics, United States Department of Agriculture, have been designated as the standard on which the grades are based. This in no way precludes the use of other methods of making moisture determinations so long as the results are corrected to conform to those secured by the standard method specified. Figure 3 gives a sectional view of the official standard moisture tester.

In making moisture tests, use the quantities of oil and grain and extinguish the flame as listed in the following table of specifications:

Kind of grain	Oil in flask	Weight of grain in flask	Extinguish the flame at—
	<i>C. c.</i>	<i>Grams</i>	<i>° C.</i>
Rough rice.....	150	100	200
Brown rice.....	¹ 150	100	200
Head rice (milled).....	¹ 150	100	200
Second head rice.....	¹ 150	100	200
Screenings rice.....	² 150	100	200
Brewer's rice.....	² 150	100	200
Wheat.....	150	100	180
Shelled corn.....	150	100	190
Oats.....	150	³ 50	195
Rye.....	150	100	175
Grain sorghums.....	150	100	190
Barley.....	150	100	190
Flaxseed.....	150	100	175

¹ Use glass-wool pad 2 inches in diameter and one-fourth inch thick in bottom of flask.

² Use double-walled flask.

³ Use special graduate which is one-half of the volume of the regular graduate; however, the regular graduate may be used by doubling the moisture-test reading.

Special points for consideration:

(1) Install the moisture tester in a place where it will not be exposed to strong air currents.

(2) The standard tester is equipped for heating with illuminating gas.

(3) Keep the wire gauze with asbestos center in good condition and so adjusted that the flame plays directly in the center of the asbestos.

(4) Place the flask so that the bottom of the flask is not less than three-eighths of an inch above the wire gauze.

(5) See that the column of mercury in the thermometer is continuous; if broken, it should be shaken down.

(6) Thoroughly mix the sample before weighing for tests; and unless the test is to be made immediately upon its arrival in the office place in air-tight container.

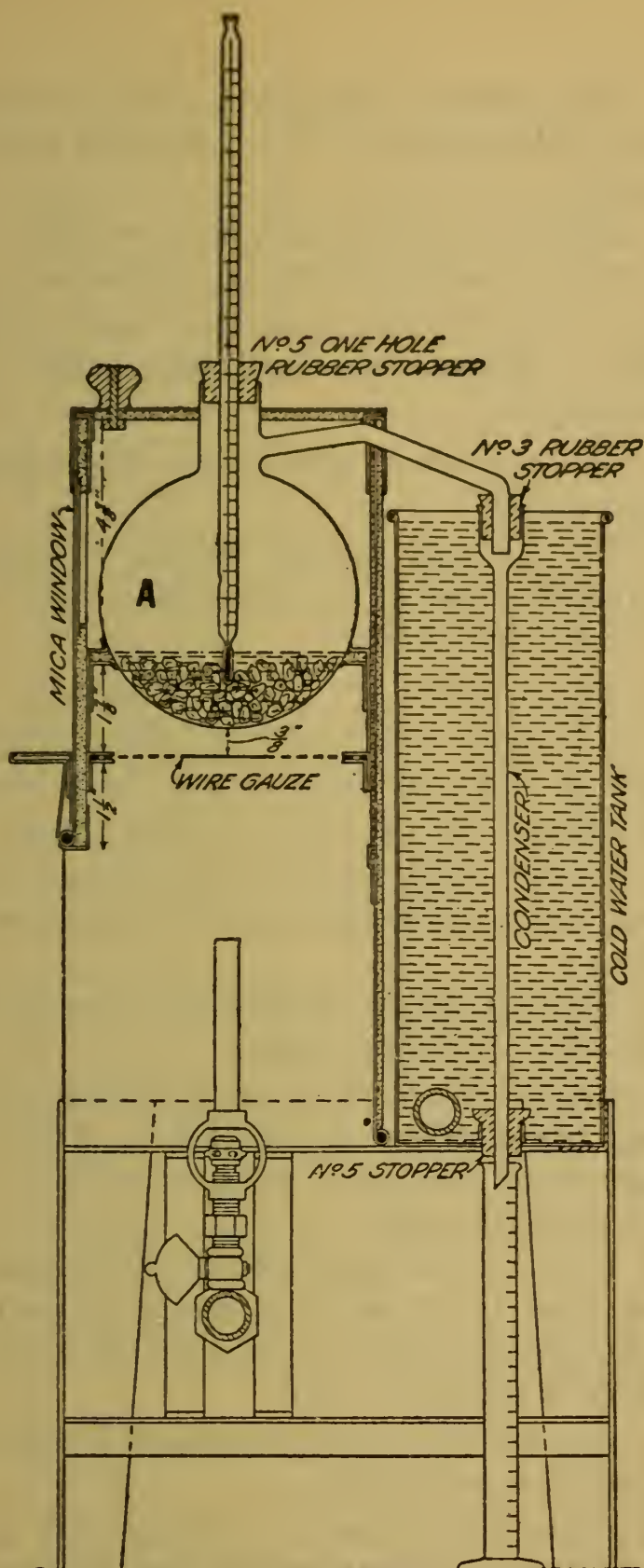


FIG. 3.—Moisture tester. Sectional view of the official moisture tester, showing the various parts properly connected for use; A, Distillation flask in position three-eighths of an inch above the wire gauze

(7) Make tests in duplicate, and if duplicates vary over three-tenths of 1 per cent make another test.

(8) Adjust the thermometers so that four-fifths of the mercury bulb is submerged in the grain and oil after the grain has been placed in the flask. (See to the adjustment each time. Do not guess.)

(9) Use correctly graduated thermometers and graduates.

(10) Do not use mushy rubber stoppers, as they absorb some of the moisture that should pass into the graduates.

(11) Clean and dry each graduate before using for a test. (Do not let them show any moisture in the bottom or along the sides.)

(12) Do not use oil directly from the previous test. Empty used flasks into a large storage can and never directly into the oil-measuring device.

(13) Keep a good circulation of cold water through the condenser tank.

(14) Adjust the heating apparatus so that the required temperature is reached in 20 minutes. A longer time will give results too low and a shorter time too high.

(15) If the moisture content of the sample is high so that there is a tendency to boil over, lower the flame until a considerable portion of the water is distilled over.

(16) Cut off the heat at the exact temperature prescribed for each grain.

(17) After the flame is extinguished a slight gradual rise in the temperature is to be expected. A sudden increase or sudden decrease in tem-

perature of several degrees indicates that the flame was too intense during the latter part of the heating, and the test should be repeated.

(18) Do not remove covers nor remove thermometers until the temperature recedes to 160° C.

(19) After the temperature has fallen to 160° C. or lower disconnect thermometer and then the delivery tube.

(20) Read the percentage of moisture in the graduated cylinder after all the drops clinging to the sides of the graduates have been shaken down. The reading is taken beneath the layer of oil on top of the water.

(21) Results of tests need not be expressed more closely than one-tenth of 1 per cent.

(22) If the water which distills over is discolored the substance has evidently been burned and the test should be repeated.

(23) When the machine is not in use keep the thermometers connected in the flasks and the flasks connected with the distilling tubes in the same manner as for making a test.

(24) Before making a test in a new flask or before using a machine that has not been in use for a 24-hour period a test should be made on a preliminary sample so that all the flasks will be uniform in condition.

(25) Place scales on a firm support and see that they are in balance before making a weighing.

(26) The specific directions given above and in United States Department of Agriculture Bulletin No. 1375 for making tests do not apply to modified forms of testers.

DETERMINATION OF MILLING QUALITY

SMITH SHELLING DEVICE

The Smith shelling device illustrated in Figure 4 is recommended for making shellings of rough rice for the purpose of determining its milling quality. The percentage of admixtures, red rice, damaged kernels, and other factors in rough rice can also be determined more readily after the hulls have been removed with the shelling device.

The Smith shelling device is fully described in mimeographed circulars USGSA-GI, Nos. 34 and 35, issued by the Bureau of Agricultural Economics, United States Department of Agriculture.

In making shellings of rough rice it is recommended that the following method be used:

Use only samples which have been freshly drawn or samples which have been kept in airtight containers for only a short length of time. The hardness of the kernels in a lot will not be correctly shown by a shelling made of a sample of rough rice which has been allowed to remain in the open air or which has been stored in a paper sack or similar container.

Use a 50-gram portion of rough rice for the shelling. This portion should be "cut" from the sample by the use of the modified Boerner sampler illustrated on page 19. Great care should be taken to see that this portion is accurately weighed.

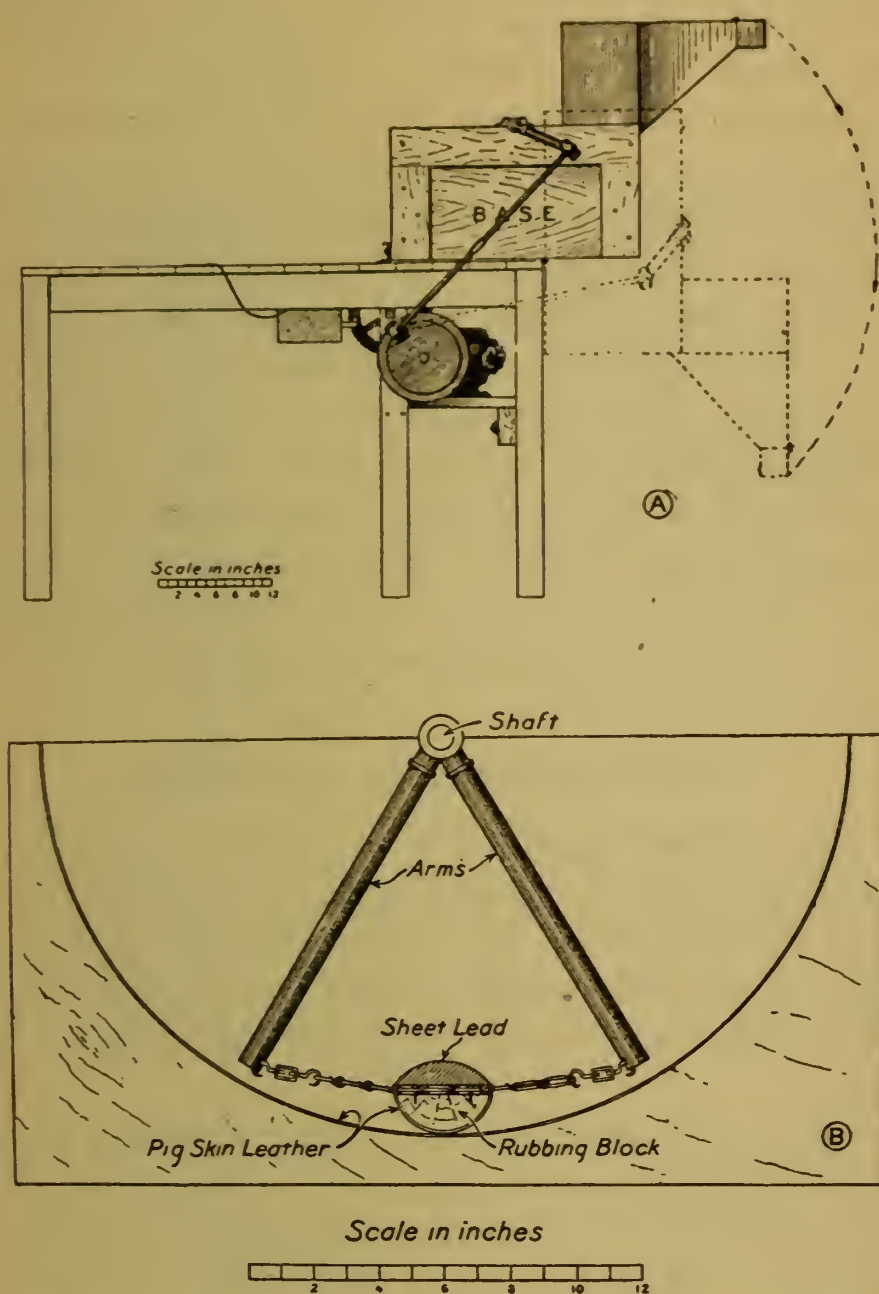


FIG. 4.—Smith shelling device. Used for rubbing the hulls off from the kernels in samples of rough rice to determine its milling quality. (a) The device assembled on a table. The dotted lines show the position of the device while it is being emptied. (b) Cross section of the base illustrating the hook-up of the rubbing block

Place the 50-gram portion in the shelling device and set the machine in motion by starting the motor. The device is equipped with an automatic cut-off switch which stops the machine after the rice has received 100 rubs. Each portion should receive 200 rubs when testing the rice for milling quality.

When the machine stops at the end of 200 rubs the rubbed rice is removed by dumping the device down over the end of the table and brushing the hulls and rice into a pan fastened to the end of the hopper. Care should be used to see that all of the rice and hulls in the "shelling" are brushed into this pan, leaving nothing in the device and without losing any of the kernels or hulls.

BATES LABORATORY ASPIRATOR

The Bates laboratory aspirator is recommended for use in separating the loose hulls from the "rubbed" rice. This apparatus makes it possible to remove the loose hulls from the shelling without the loss of the finely broken particles of rice.

After the loose hulls have been removed from the shelling the remaining portion may be analyzed for whole and broken kernels, red rice, and damaged kernels, or any other factor which is more readily determined with the hulls removed.

Plans and specifications for constructing the Bates laboratory aspirator may be obtained without cost from the Bureau of Agricultural Economics, United States Department of Agriculture.

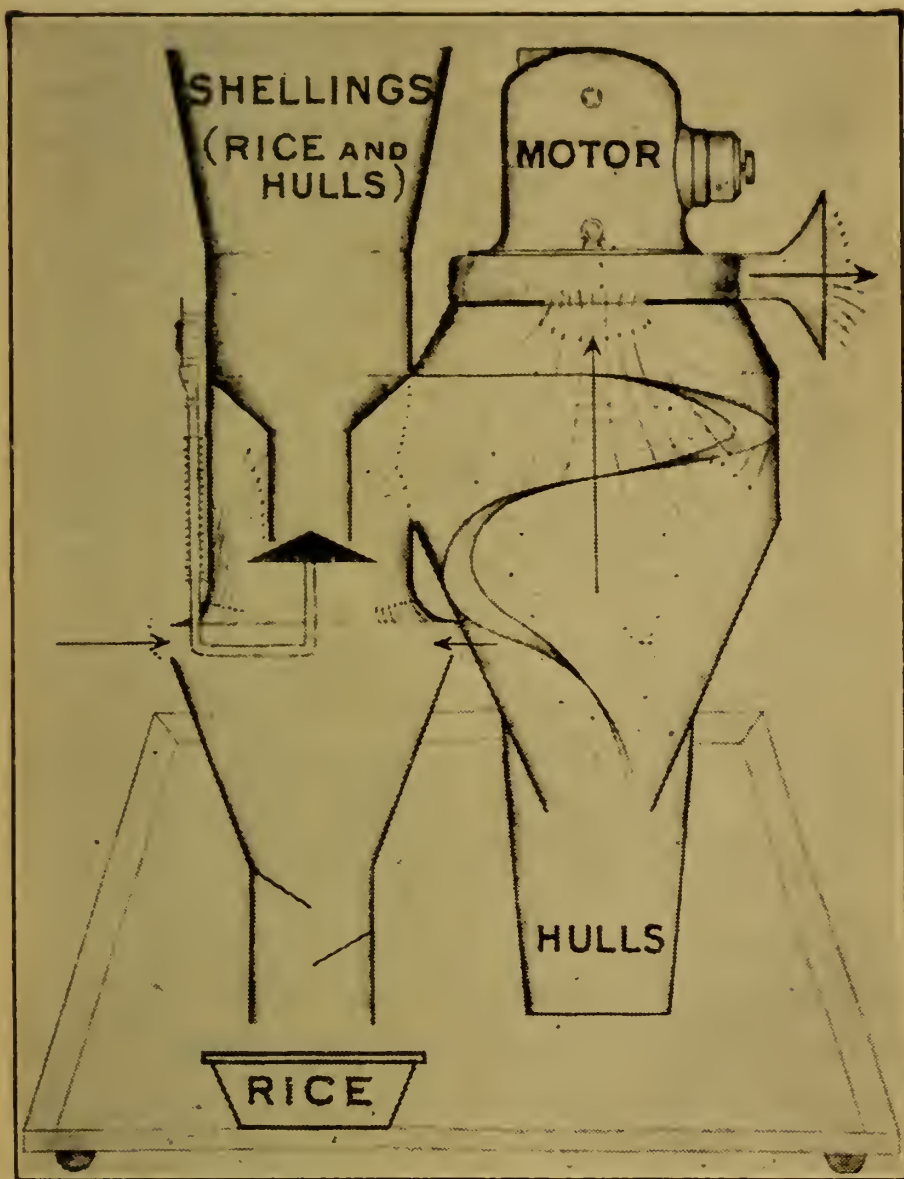


FIG. 5.—Bates laboratory aspirator. Used for removing the hulls from rubbed samples (shellings) of rough rice

SIEVES HELPFUL IN DETERMINING MILLING QUALITY

In the determination of whole and broken kernels the use of a No. $6\frac{1}{2}$ sieve and also a No. $5\frac{1}{2}$ sieve will be found helpful. Most of the broken kernels can be removed from the shelling with the sieves and the remaining broken kernels can then be readily separated from the whole kernels by hand picking.

METHOD OF DETERMINING FOREIGN MATERIAL AND FINELY BROKEN KERNELS

EQUIPMENT FOR MAKING THE SEPARATION

In determining the quantity of foreign material and finely broken kernels in connection with the grading of rough rice the following equipment is used:

Set of perforated metal hand sieves. The sieves and bottom pan should be circular in shape and made of aluminum, brass, or other suitable material. The smooth surface of the metal in the sieves should be face up. The metal should be 0.025 to 0.035 inch in thickness.

(a) Bottom pans: The inside diameter across the top of the pan should be $13\frac{3}{4}$ inches; the inside diameter across the bottom of the pan should be 13 inches; depth $2\frac{9}{16}$ inches; and roll at top of pan $\frac{3}{16}$ inch in diameter.

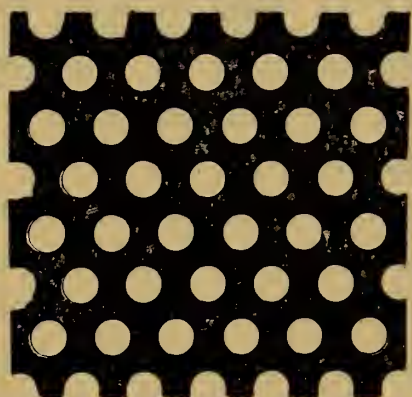
(b) No. $6\frac{1}{2}$ sieve: With round perforations six and one-half sixty-fourths inch in diameter; inside diameter across the top of the sieve should be $13\frac{3}{4}$ inches; inside diameter across the bottom of the sieve should be 13 inches; depth $1\frac{7}{8}$ inches; and roll at top of sieve $\frac{3}{16}$ inch in diameter.

(c) No. 12 sieve: With round perforations $\frac{1}{8}$ inch in diameter; inside diameter across the top

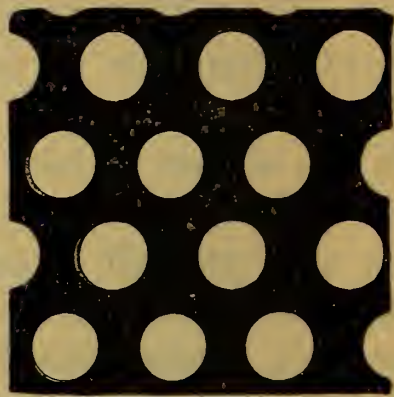
of the sieve should be $13\frac{3}{4}$ inches, inside diameter across the bottom of the sieve should be 13 inches; depth $1\frac{3}{8}$ inches; and roll at top of sieve $\frac{3}{16}$ inch in diameter.

NOTE.—The No. $6\frac{1}{2}$ sieve should be made to nest very freely with the bottom pan. The No. 12 sieve should be made to nest very freely with the No. $6\frac{1}{2}$ sieve.

It is absolutely essential that the dimensions of the perforations of the sieves used be exactly as stated above. A slight variation in the dimensions materially influences the percentage of matter which will pass through the sieve. To secure the exact size it is necessary that the perforations be cut with dies especially made for the purpose. Sieves made from tin or galvanized iron with an ordinary punch will not give accurate results. The shape and arrangement of the perforations are shown in Figure 6, and the manner of nesting of the sieves is shown in Figure 7.



No $6\frac{1}{2}$



No.12

FIG. 6.—Illustrating the perforations (full size) for the No. $6\frac{1}{2}$ and No. 12 sieves adopted by the United States Department of Agriculture in connection with the grading of rough rice



FIG. 7.—Nest of two sieves and bottom pan. Bottom pan has an inside diameter of 13 inches and is $2\frac{9}{16}$ inches deep. The No. $6\frac{1}{2}$ sieve nests freely with the bottom pan and is $1\frac{7}{8}$ inches deep. The No. 12 sieve nests freely with the No. $6\frac{1}{2}$ sieve and is $1\frac{3}{8}$ inches deep

METHOD FOR MAKING THE DETERMINATION

The following method for determining foreign material and finely broken kernels in rough rice should be used:

Not less than 50 grams and preferably 100 grams of the original sample should be used for screening. The portion should be shaken on the nest of sieves and bottom pan until it is apparent that no more material will pass through the sieves.

Kernels of rice, either single or in clusters, which remain on the No. 12 sieve after screening should be removed and placed with the rice which remains on the No. 6½ sieve.

The mud lumps, cereal grains, weed seeds, and other foreign material remaining on the No. 12 sieve after screening and all of the material of every kind passing through the No. 6½ sieve function as separable foreign material and finely broken kernels.

A representative portion of at least 50 grams of the rice remaining on the No. 6½ sieve after screening should be analyzed for mud lumps, cereal grains, and weed seeds. Mud lumps and cereal grains, when found in this portion of rice, are grading factors, and the sample should be graded for each of these factors according to the limits prescribed in the grades on pages 3 and 5. Weed seeds, when found in excess of 0.5 per cent for the subclass California-Japan and 0.1 per cent for all other rices, after the removal of separable foreign material determine whether a sample is "seedy" or "very seedy" as stated on pages 8 and 9.

Great care should be used in sieving the samples as the limits for mud lumps, cereal grains, and weed seeds left in the rice after screening are much more stringent than the limits for separable foreign material and finely broken kernels. In so far as possible the foreign material should be removed with the sieves.

APPARATUS FOR GRADING ROUGH RICE

To equip laboratories for the grading of rough rice according to the United States grades for rough rice the following equipment is regarded as essential:

1. Brown-Duvel moisture tester, completely equipped with flasks; certified centigrade thermometers to read correctly from 170 to 200°; graduates of 25 c. c. capacity; one-hole rubber stoppers, sizes Nos. 5 and 3; condenser tubes; 150 c. c. oil measuring device; supply of oil, etc. (See United States Department of Agriculture Bulletin No. 1375.)

2. Balance, capacity 500 grams, sensitive to one-tenth gram, with set of weights, 1 gram to 500 grams.

3. Balance, capacity approximately 50 grams, graduated beam to read 1 gram and fractions of a gram, sensitive to one-tenth gram, with set of weights 1 gram to 50 grams.

4. Sieves and pan for use in the determination of "foreign material and finely broken kernels" in rough rice:

(a) Bottom pan: The inside diameter across the top of the pan should be $13\frac{3}{4}$ inches; the inside diameter across the bottom of the pan should be 13 inches; depth $2\frac{9}{16}$ inches; and roll at top of pan $\frac{3}{16}$ inch in diameter.

(b) No. $6\frac{1}{2}$ sieve: With round perforations six and one-half sixty-fourths inches in diameter;

inside diameter across the top of the sieve should be $13\frac{3}{4}$ inches; inside diameter across the bottom of the sieve should be 13 inches; depth, $1\frac{7}{8}$ inches; and roll at top of sieve, $\frac{3}{16}$ inch in diameter.

(c) No. 12 sieve: With round perforations $\frac{1}{8}$ inch in diameter; inside diameter across the top of the sieve should be $13\frac{3}{4}$ inches; inside diameter across the bottom of the sieve should be 13 inches; depth, $1\frac{3}{8}$ inches; and roll at top of sieve $\frac{3}{16}$ inch in diameter.

NOTE.—The No. $6\frac{1}{2}$ sieve should be made to nest very freely with the bottom pan. The No. 12 sieve should be made to nest very freely with the No. $6\frac{1}{2}$ sieve.

5. A modified Boerner sampler for correctly dividing a sample into smaller portions for analysis and moisture determinations. (See United States Department of Agriculture Bulletin No. 857.)

6. Trier for bulk rough rice. The trier should be double-shelled and divided into compartments, and should be 60 inches long.

7. Sampling canvas, 5 by 2 feet in dimensions, on which to empty the rice from the trier.

8. Trier for sacked rough rice.

9. Air-tight containers (sample cans), capacity approximately 450 grams.

10. Cloth sample bags, waterproofed, capacity at least 2 quarts.

11. Grain pans, with spout for pouring into other containers.

12. Smith shelling device, equipped with motor and automatic cut-off switch.

13. Laboratory aspirator for removing loose hulls from shellings of rice.

In addition to the apparatus listed above, the following equipment will be found convenient and desirable:

1. Extra moisture-testing equipment: Flasks, thermometers, graduates, rubber stoppers, test-tube cleaners, etc.

2. Five-gallon oil can equipped with faucet.

3. Five-gallon oil can equipped with strainer funnel to recover oil.

4. Five-gallon refuse can.

5. Small funnel to fit in moisture flasks for pouring sample into the flasks.

6. Tweezers for mechanical analysis.

7. Small grain scoop.

8. Brush for cleaning up rice and rice dust.

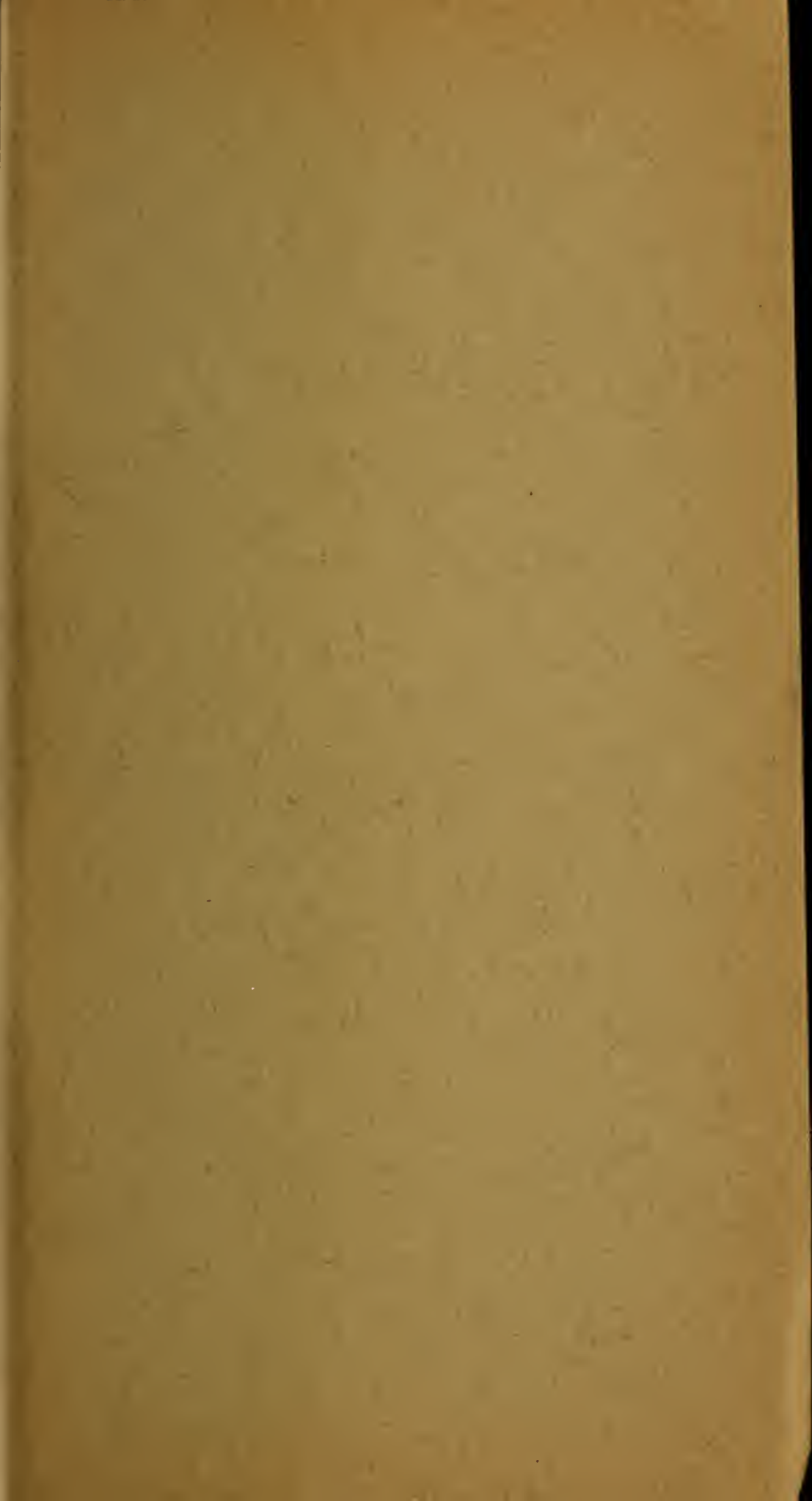
9. Heavy table for handling samples, analysis, etc.

10. Furniture, including chairs, stationery supplies, files, etc., to keep proper records.

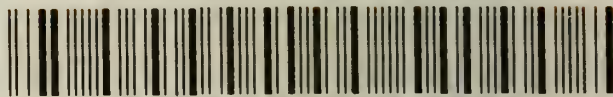
FURTHER INFORMATION

For further information regarding the inspection and grading of rough rice in accordance with the provisions of the United States grades for rough rice apply to any Federal field office of rice investigations or to the Bureau of Agricultural Economics, United States Department of Agriculture, Washington, D. C.





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